Structural evolution of Northern Bakony Mts.

Thesis

Author: Kiss Adrienn

Doktoral programme in Earth sciences
Dr. Monostori Miklós

Programme of geology/geophysic
Dr. Monostori Miklós

Supervisor: Dr. Fodor László PhD
2009

INTRODUCTION

The study area is situated in the northern Bakony Mountains (Transdanubian Range, western hungary) between Ugod and Bakonynána. It is involved the Telegdi Roth fault, Porva-basin, Hódos, aranyos and Kökényes basin and the Castle hill of Csesznek. The aim of the thesis was to describe the tectonic elements of the northern Bakony Montains related to Alp-Carpathian structural evolution. The Bakony Mts., as a part of the Transdanubian Range (TR) is interpreted as the uppermost situated Cretaceous thrust sheet within the Alpine nappe pile. Former thrust-planes were reactivated as detachment faults, and the Transdanubian Range forms the hanging wall of a Miocene detachment fault system running down from the Kőszeg-Rechnitz window. The desription of fault pattern, its kinematic characteand the structural evolution can be used as analogy in other area. Some of the new data can have implications for the structure of the whole Pannonian Basin.

METHODS

For the structural analysis, microtectonic data like brittle faults, joints and stylolites were used. Based on the kinematic compatibility faults belonging to the same tectonic phase were selected to the same fault set. Stress axes were defined by the palaeostress-analyses. After the paleostress tensor calculation, data with similar paleostress axes were grouped into separate phases.

I completed the microtectonic measurements with structural mapping of the area. Particularly, we modified the fault pattern of earlier maps. Outcrop-scale observations, the determined stress axes, apparent map displacements and cross sections were used to determine the fault kinematics; this was not completed on earlier maps.

THESIS AND RESULTS

1. At least 10 tectonic phases took part in the structural evolution of the northern Bakony Mts. As follows in cronological order: (1) Jurassic NNE-SSW tension, (2) early Cretaceous (Barremian? – Aptian?) – early-Albian) NW–SE compression (3) middle Albian W(NW) – E(SE), and W(SW) – E(NE) extension, (4) Cenomanian - Turonian compression, (5) Campanian – Maastrichtian NE – SW extension, (6) late Senonian – Paleocene strike-slip and/or compressional deformation with WSW-ENE max. horizontal stress, (7) middle Eocene – early Miocene strike-slip stess field with WNW-ESE max. horizontal stress, (8) Karpatian – Badenian NE-SW extension, (9) Sarmatian transpressional stress field, (10) late Miocene (?) – Pliocene-Quarternary (?) extension.

2. Bakonybél fault (Tari 1995), as a prominent, several km long fault of the northern Bakony Mts., was generated in the early Cretaceous (Barremian?-Aptian? – early Albian) NW-SE compressional stress field. Kinematics of this fault, just like its subparallel one (Cuha thrust, Taeger 1935) was sinistral thrusting, thus it can be interpreted as oblique thrust fault. South of the study area thrust fault appearing within the Csollános valley section (Fodor 1998), which is related to the middle Albian deformation, I interpreted as the southern continouation of Bakonybél fault. Generation of the oblique thrust fault can be connected with the formation of the syncline, and so with the first phase of the Alpian thrust system evolution.

3. Middle Albian structural history of the northern Bakony Mts. is indicated by previosly not documented WSW-ENE oriented extensional stress field. Extensional phase resulted in forming of synsediment normal faults and also rollover anticline (Pintér Hill and Biancone quary, Zirc). The middle Albian extension is a newly recognized episode within the structural evolution of the Transdanubian Range.

4. The middle Eocene – early Miocene phase can be described with WNW-ESE maximum horizontal stress. The PhD thesys provide several new evealuated microtectonic data to the statement that the maximum horizontal stress has similar importance as the $\sigma 3$ has within this tectonic phase, in some cases it played more significant role in the deformation. Consequently the stress field has changed between the strike-slip – transpressional and the compressional type. This conclusion is also suggested by the geographic occurance of Eocene formations. The Eocene accomodation space was separeted by NE-SW directed highlands, ridges. This palegeographic situation induces considering that strong tectonic control influanced the Eocene depositional system.

5. Generation of Porva Half-graben occured in the Karpatian – Badenian extensional stress field, when NE-SW striking normal faults were formed. Half-graben tectonics suggested by microtectonic data, rollover anticlines and reactivation of Bakonybél thrust fault with normal sense, proves the extensional character of the first period of the synrift phase in Bakony Mts., which was responsible for the generation of the Pannonian Basin.

6. Sarmatian stress field shows transpressional sense with NNW-SSE maximum horizontal stress based ont he microtectonic data recorded in the northern Bakony Mts.. The main deformation of the dextral transpressional Csesznek Zone including en echelon thrust faults and folds took part in this tectonic phase. Marks of transpression were also observed along the Telegdi Roth fault, which is paralel to the Csesznek Trend. It indicates that while extensional deformation related to Alp-carpathians subduction continued int he Eastern part of the Pannonian Basin in sarmathian, the stress field of Northern Bakony Mts. Shows tectonic pattern similar to the Alp-dinarian region.

7. Normal faults corresponding to Late Miocene (?) – Pliocene – Quarternary (?) NNW-SSE oriented extension appear int he northern Bakony Mts. N-S striking faults segmented the Csesznek Ridge. In that phase. Fault running ont he eastern side of Kőris-Hill generated some proven half-grabens. Hódos-Graben, which can be medelled as a rifted graben opened in this phase. This deformation can be connected to the thermal subsidence of the Pannonian Basin.

REFERENCES

Fodor L. (1998) Late Mesozois and early Paleogene tectonics of the Transdanubian Range. – *Abstract volume, XIVth CBGA Congress, Vienna, Austria, 165.*

Taeger, H. (1935): A Bakony regionális geológiája. — *Geol. Hungarica Ser. Geol. 5, 118 pp.*

Tari, G. (1995): Eoalpine (Cretaceous) tectonics in the Alpine/Pannonian transition zone. — In: Horváth, F., Tari, G. and Bokor, Cs. (editors) Extensional collapse of the Alpine orogene and Hydrocarbon prospects in the Basement and Basin Fill of the Western Pannonian Basin. *— AAPG International Conference and Exhibition, Nice, France, Guidebook to fieldtrip No. 6. Hungary, 133–155.*

REFERENCES OF ADRIENN KISS

Kiss, A., Gellért, B. & Zöld, A. (1998): A Porvai-medence szerkezetfejlődése a Bakony tektonikai viszonyainak tükrében. ELTE, Alkalmazott és Környezetföldtani Tanszék. Tudományos diákköri dolgozat.

Kiss, A., Gellért, B, & Zöld, A. (1999): Structural evolution of Porva Basin within the tectonic relations of Bakony Mts., Transdanubian Range, W-Hungary. Ifjú Szakemberek ankétja, Siófok, Előadáskivonat, p. 25-26.

Kiss A. (1999): A Porvai-medence szerkezetalakulása. ELTE, Alkalmazott és Környezetföldtani Tanszék. Szakdolgozat.

Kiss, A. & Gellért, B. (1999): Structural evolution of the Porva Basin in the Northern Bakony Mts, Transdanubian Range, Hungary. *The winter session of 5th Carpathian Tectonic Workshop,* Szymbark.

Kiss A. és Gellért B. (2000): A cseszneki Vár-hegy szerkezetalakulása. Ifjú Szakemberek ankétja, Debrecen, Előadáskivonat, p. 67-68.

Kiss, A. & Fodor, L. (2001): Structural evolution of the Northern Bakony Mts. *Pancardi, Geological Meeting on Dynamics of Ongoing Orogeny*, Sopron, p. 119.

Kiss, A., Gellért, B., Fodor, L. (2001): Structural evolution of the Porva Basin in the Northern Bakony Mts. (western Hungary): implications for the Mesozoic and Tertiary tectonic evolution of the Transdanubian Range and Pannonian Basin. Geologica Carpathica, 52, 3, p. 183-190.

Kiss, A. & Fodor, L. (2003): Brittle structures of the Bakony Hills (Western Hungary: constrains from paleostress analysis and local structural mapping. *VI-th Alpshop Workshop,* Sopron, p. 92.

Sasvári, Á., Kiss, A. & Csontos, L. (2003): Microstructural investigation of the Telegdi Roth Line (Bakony Mts, W Hungary) Structural evolution of the Northern Bakony Mts. *VIth Alpshop Workshop,* Sopron, p. 91.

Kiss, A. (2003): Csesznek, Vár-hegy: felső triász Dachsteini Mészkő és középső-eocén Szőci Mészkő, valamint a cseszneki Vár-hegy szerkezetalakulása. VI: Magyar Paleontológiai vándorgyűlés Zirc, vezetőfüzet, p. 43.

Kiss A., & Fodor L. (2003): Brittle structures of the Bakony Hills, western Hungary: constraints from paleostress analysis and local structural mapping. – Annales Universitatis Scientiarum Budapestiensis de Rolando Eötvös Nominatae, 35, 92–93.

Kiss, A. & Fodor, L. (2005): Cretaceous structural evolution of the Bakony Mts., Hungary. – *Geolines* 19, 61–63.

Sasvári, Á., Kiss, A., Csontos, L. (2007): Paleostress investigation and kinematic analysis along the Telegdi Roth Fault (Bakony Mts., Western Hungary). – Geologica Carpathica,58,5,447-486.

Kiss, A. & Fodor, L. (2007): Miocene dextral transpression along the Csesznek Zone of the northern Bakony Mountains (Transdanubian Range, western Hungary)– Geologica Carpathica,58,5,465-475.